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ABSTRACT

This paper presents research designed to study the West African Examination Council's (WAEC) policy and its impact on teaching chemistry in Nigerian secondary schools. Five knowledgeable public figures in Nigeria and Great Britain were interviewed concerning policy formulation and implementation. Five pertinent documents were analyzed. Ethnographic methods were used to develop the case study. A database was developed from field-notes, data from interviews, and questionnaires administered to education officials, chemistry teachers, school administrators, and students. The interview data yielded salient information about the operation of WAEC in West Africa and Nigeria, compared with that of the University of London School Examinations Board (ULSEB) in England. Two main differences were observed: (1) the strong influence of the African government on WAEC's operation, whereas, the ULSEB is not influenced by the British government; and (2) the issue of security, which has led to examination leakages in African states. Implications and conclusions drawn from the study include the need to: develop strategies to improve organizational communication in the Nigerian centralized educational system; and (2) improve preservice training of chemistry teachers to make them more effective communicators of scientific information. (CW)

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INFLUENCES OF EXAMINATION POLICIES ON CHEMISTRY TEACHING PRACTICES IN NIGERIAN HIGH SCHOOLS: AN ETHNOGRAPHIC STUDY

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INTRODUCTION

This paper is a report of a study about how West African Examination Council's examinations and examination policy affect secondary science education in Nigeria. The researcher employed three main sources of evidence for data collection. These include, open-ended interviews, content analysis of pertinent documents and an ethnographic study of selected secondary schools in Ibadan, Nigeria.

Relevant information about examination policy and its influence on practice was obtained first, by interviewing five selected knowledgeable public figures in Nigeria and at the University of London, England; second, from conversation and interviews with, and questionnaire completed by school administrators and chemistry teachers within Ibadan municipality; and third, from questionnaire completed by students enrolled in chemistry classes at one high school. The researcher also conducted an ethnographic survey of the learning environments at this same high school. Field and classroom observation notes together with data collected with three instruments formed the data base for the study.

The Context of Nigerian Secondary Education

As a way of ensuring credibility and stability in the educational system, Nigeria and four neighboring West African nations established and maintained the West African Examination Council (WAEC) in conjunction with the University of London. The organization formulates and disseminates curricular policy and examinations in all of the academic subjects in secondary schools. WAEC operates through a complex network of organization in each of the member nations (See Figure 1). In Nigeria, the network has two levels of organization - a Federal organization and a state level organization in each of Nigeria's twenty one states. This organizational level allows for a two way flow of information and influence. Schools, universities, governmental agencies, labor unions, potential employers of graduates and other groups are able to provide input into WAEC's work in formulating and disseminating policies, syllabi, and examinations. Similarly, the policies, syllabi, and examinations prepared by WAEC influence the educational system at Federal, state, and individual school levels.

Insert Figure 1 about here

WAEC syllabi and examinations provide school officials, teachers, students, universities, and potential employers

a clear, uniform statement about expectations. Syllabi and examinations are designed to be congruent. That is, the examinations test students on the subject matter content defined in the syllabus. Further, it is expected that teachers and students will focus their work in this content. Thus, the intention of WAEC is to give uniform substance to the school curriculum across the five member nations by providing syllabi and examinations which will guide school officials, teachers, and students in their work. Syllabi and examinations do change as new needs arise. However, changes generally require five years from initiation to implementation, providing the educational system with an important element of stability. This allows for broad input from many constituencies prior to decisions on change and broad dissemination to "users" afterward.

STATEMENT OF THE PROBLEM

Testing and educational measurement are common features of educational systems around the globe. Varieties of tests and test batteries are utilized by teachers, and other professional practitioners to achieve different goals. Teacher-made tests (McGuire, 1968; Karmel, 1970) are the most common and there are myriads of standardized tests in use by professionals in the Western hemisphere (Borg and Gall, 1984). Test score usages range from ability grouping of a class of students to prediction of scholastic aptitude and college admission (Boyce and Paxson, 1965).

In Nigeria, however, tests scores are used for three main purposes. First, to qualify for promotion from one grade level to another in a school. Second, to satisfy the requirements laid down by the West African Examination Council in order to obtain the paper qualification, a "passport" for securing a position in a public service department (Hanson, 1971).

Third, many secondary school students in the country aspire to reach the apex of the national educational pyramid. Invariably, the gateway to this status is to matriculate at a Nigerian university or college. A satisfactory performance in the West African School Certificate examinations (Nwachukwu, 1986) strongly determines admission to any post-secondary institution in the country.

One of the national objectives of secondary education in Nigeria is for the youths to develop a scientific attitude toward problem solving (Fafunwa, 1971). This could be interpreted to mean acquisition of skills in problem solving and reflective thinking, development of technical and vocational skills and an understanding of the natural and man made environment. These attributes may all be included in our characterization of a scientifically literate person. We may go further to say that such a person has learned science in a meaningful way. What then is meaningful learning of

science? Are Nigerian youths learning science in a meaningful way? If not, how can one go about influencing the educational policy of the country to facilitate curriculum change that will provide requisite conditions for effective science teaching and meaningful learning of science in schools?

It is common practice for critics of schools to blame the poor performance of students on factors such as teachers' qualification, lack of adequate materials, the scope and the contents of syllabus and several other extraneous issues for the low scores in school, state and national examinations.

Examinations affect the character of education in many ways. First, the standard of education is measured by performance of students in the West African School Certificate Examinations. The "gradual deterioration" in the standard of education has been highlighted by some authors (Adeogun, 1985).

Second, the road to a post-secondary career today is strewn with challenges, and many high school graduates are struggling to secure the limited admission offers to higher education. The performance of students in the West African School Certificate examinations plays a significant role in determining the careers of students in general, and their admittance into post-secondary institutions in particular.

Policy and Philosophical Control of Education

In Nigeria, the power to control formal education is vested in the federal government. The administration and organization of schooling are controlled by the federal, state and local governments or their agencies, like the federal and state Ministries of Education, the National Board for Technical Education, the Industrial Training Fund (Work et al, 1982) and the Nigerian Universities Commission.

The Nigerian national policy on education spells out both the philosophy and objectives of education at different levels namely, pre-school, primary, secondary and higher education. Nigeria's national ideology which endorses the necessary foundation for the national policy on education include:

> A free and democratic society; a just and egalitarian society; a united strong and self reliant nation; a great and dynamic economy; a land of bright and full opportunities for all citizens.[1]

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[1]Federal Republic of Nigeria, National Policy on Education, Published by the Federal Ministry of Information, Printing Division, Lagos 1977 (Revised 1981).

Nigeria's egalitarian philosophy of education is based on the integration of the individual into a sound and effective citizen and provides equal opportunities for all citizens both within and outside the formal school system.

Trends in Student Achievement in Science Subjects at the Ordinary Level

An attempt is made here to present some data on the trends and pattern of achievement of students in science (chemistry), mathematics and English language. Two basic assumptions were made by the researcher. First, that students are not likely to perform very well in chemistry if they have weak backgrounds in mathematics and/or English language. Students who for example cannot manipulate simple arithmetic functions like ratios, or write a straight forward description of a chemical process in readable and understandable language are not likely to do very well in WAEC chemistry examinations.

Records of students' acheivements in the West African School Certificate examinations at the O' level in English Language, chemistry and mathematics for five years (1980-1984) are presented in Table 1. The data were generated from selected documents, collected in the field and processed using the MINITAB - a computer software package.

Insert Table 1 about here

Table 1 provides comparative data on the proportions of candidates who passed and failed the three subjects between 1980 and 1984.

These data show that the achievement of students in English, mathematics and Chemistry varies periodically from year to year. These variations should raise questions about the reasons which underlie them. Are these the result of variation in difficulty of the tests or are there more elusive factors which underlie seemingly sporadic shifts from one year to the next?

Data in Table 1 show that the total entry in each academic subject increased by at least 100 percent in less than five years. These data show that WAEC has been dealing with more and more candidates each year. The increased administrative responsibility probably led to the establishment of WAEC offices in each of the 19 states[2] of the federation.

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[2]The number of states in Nigeria increased to 21 in 1987 when two more states were created by the present military administration.

Another significant issue emerging from Table 1 is the rapid increase in the failure rates in each subject. In chemistry the percentage increase was more than 200 percent in 1981 and has remained high ever since. The failure rates in mathematics rose continuously, it reached over 63 percent in 1984. The percentage of students who failed English language reached 73 percent in 1981 and has remained at about 60 percent level (Figure 2).

Insert Figure 2 about here

Review of Pertinent Literature

Research data for the study were collected in the field using a combination of ethnographic and field research techniques viz., interviews, administration of questionnaires and collection of documents for content analysis; and observation of the school level and classroom level environment at Alanamu Secondary School (pseudonym), Ibadan.

Field methods was defined by Conklin (1968) as data of cultural anthropology obtained by observing the behavior of people in a given society. Thus field researchers often employ several strategies to collect data to set up categories. Ethnography can be equated to anthropology (Erickson, 1979). The only difference between cultural anthropologists and school ethnographers is that the former study the cultures of any social groups whereas the latter limit their study to school setting as cultures. Gallagher (1985) provided a list of the similarities between ethnography and cultural anthropology.

Observation is an important aspect of the ethnographer's work. It has been regarded as a powerful tool of inquiry. Observation is an everyday phenomenon, which is part of the everyday functioning of individuals in their social interaction, and their conduct of the business of living. In observational research, the observer often augments the observation process by using a tool or instrument to focus or guide observation. The observation instrument is influenced by the observer's goals, biases, frame of reference and abilities. The instrument also constrains what will be observed, recorded, analyzed and described. Observation is thus regarded as a mediated process (Fassnacht, 1982). The descriptive records acquired during an observation are statements about reality in a given context.

According to Fassnacht (1982), four major issues are associated with observation in educational settings. These include:

1. Observation as a means of representing reality in an education setting.

2. Observation as a contextualized process.

3. Mechanisms or tools for recording and sorting observations.

4. Factors involved in observation: units of observation/-aggregation of data; sampling, and source of error.

Because observation is a contextualized process (Brophy and Evertson, 1978; Erickson & Schultz, 1981), it was necessary for this researcher to address the issues related to the ways of looking at context viz., local context as embedded in larger levels of context; historical context of the setting; historical context of the specific event under study; and context of the research approach. The significances of the attention given to the context of a study have been discussed by some authors (Florio & Schultz, 1979).

Another issue that guided the review is how policy relates to practice. In his long essay titled "Educational Technology, Policy and Practice", Cohen (1987) indicated first, that policies and program depend on practice, and second, that instructional practice in schools is situated in a larger organization and a longer history of academic instruction than are usually considered. The author went further to identify three factors which in general affect the way teachers teach in American schools. The third factor which is most relevant to this study is the social organization of school systems. Cohen compared the structures of the centralized systems in the United Kingdom, Singapore and some states in Australia, and the decentralized system characteristic of the American education in general. He indicated certain features in the centralized system. These features viz., formal inspection of schools as by Her Majesty Inspectors in England and effective communication networks among teachers and schools, are regarded as advantageous. He argued that decentralization impedes communication about practice, which according to him, is a problem that plagues public education in America.

Since teachers were the main focus of the research, it is quite in order to present a review of the literature on the teachers' attitudes toward examinations.

Hilsum and Strong (1978) (British educators) reported that public examinations (exams) are an all year round feature of schooling, taking up a large proportion of teacher's day and teachers may spend at least twenty minutes a day on average on the consultation, administration and supervision of these exams. Teachers also participate in other aspects of the examining process which include, subject panels, external examining, and moderating.

Scarth's study of schooling at Brookview (Scarth, 1984) was an exploration of teachers' perceptions of and orientation to examinations. Some authors have criticized the central position of examinations for assessment in secondary schools. Others like Broadfoot (1979) focused on exams as constraints.

Later in this paper, the researcher has presented three levels of implementing curriculum policy. One of these is the operational level which is illuminated by two fields of educational research. These are school and classroom level environment research. School environment research is often associated with the field of educational administration based on the assumption that schools can be viewed as formal organizations (Deer, 1980). Although school level environment instruments have been developed (Richman, 1979), the data presented later in this paper will be discussed with reference to the works of Fraser and associates (Rentoul and Fraser, 1979), who currently have done substantial work in this field. According to these authors, "The strongest tradition in classroom environment research involves use of the classroom perceptions of students (or sometimes teachers) as predictors of student cognitive and affective outcomes." Rentoul and Fraser's study has provided convincing and consistent support for the predictive validity of classroom environment perceptions in accounting for appreciable amounts of variance in student outcomes, beyond that attributable to student characteristics such as intelligence or pretest performance.

CONCEPTUAL FRAMEWORK

The conceptual focus for this study is "effective communication" (Hovland, et al 1959). Effective communication was chosen because it provided a logical framework for the analysis and interpretation of the data collected in the field.

Communication was a relevant concept at different levels of data acquisition. Effective communication provided the opportunity to draw important and logical inferences from processed data. For example, the content analyses data were analyzed as contents of communication at the various levels of policy and curriculum formulation and implementation.

Purpose of the Study

The main research question of the study is the following: How does examination policy influence teaching of chemistry in Nigerian schools?

Subsidiary questions which need to be answered include:

1. What are the factors controlling the formulation ard implementation of examination policy in Nigeria?

2. What degree of influence does examination policy have on teaching chemistry in secondary schools?

3. What is the procedure for reviewing the WAEC 'O' level syllabus in chemistry?

4. What degree of correspondence exists between the elements which give substance to the curriculum including

   4a. National curriculum objectives in chemistry.

   4b. the contents of textbooks and other instructional materials which are available for use by chemistry teachers.

   4c. IUPAC chemistry textbook.

   4d. the WASC 'O' level chemistry examination papers 1 & 2 and

   4e. observed contents of instruction in selected classes?

5. How is the WAEC examination policy implemented at the school and classroom levels?

   5a. How is the available class time utilized in the chemistry classes at Alanamu Secondary School, Ibadan?

   5b. What instructional strategies are employed by chemistry teachers in the school?

   5c. What is the quality of the teaching and learning environment in the school?

The current concern of the Nigerian public and stakeholders about public education is the apparent decline in student achievement in the West African School Certificate (WASC) examinations.

It has been indicated in the literature that the implementation of science curricular packages is inadequate for teaching.

Communication problems may be among the major causes of the poor achievement in chemistry in Nigerian schools. The failure of teachers to teach according to the curricular guidelines may be due to their response to the contents of the W.A.E.C. guide syllabuses and other curricular guides and components. Perhaps some communication problems also exist at other levels of implementing examinations policy.

METHODOLOGY

Field research methods and ethnographic techniques (Gallagher, 1985) were used for data collection. The sources of evidence included data from interviews of selected education

officials, content analysis of pertinent documents, field notes and artifacts collected during the school level and the classroom level observation at Alanamu Secondary School, Ibadan, responses to questionnaire by administrators and teachers in other schools in Ibadan, and responses by students to a questionnaire on classroom environment. Field research methods have provided a rich knowledge of the milieu of science instruction and learning in the school including detailed descriptions of the nature of the teacher-pupil interaction at the classroom level, and the role of the school administrators. Furthermore, the content analysis data also presents a clear picture of the nature of communication between policy makers and those who implement policies in classroom.

Three instruments were used to collect pertinent data in the field. These include first, an open-ended interview protocol used to interview the five key education officials. Second, is a survey questionnaire administered to seventeen people including, three school administrators, two state education officials and twelve chemistry teachers. The third is an instrument used to measure students' perceptions about how available time is utilized in their individual classroom. The three instruments are briefly described below.

Instrument No. 1

This interview protocol is divided into four sections. Each section was used to conduct an in-depth probe of each respondent to acquire some knowledge of the process of formulating and implementing examination policy for Nigerian secondary schools. The open-ended questions in each section gave each respondent the freedom to express his or her opinion, and to provide other relevant information implied but not expressed by the questions. This unique property of the interview technique is described by Borg and Gall (1984):

The issues dealt with by each section of the instrument are as follows:

1. The role of the West African Examination Council.

2. Procedures used in formulating examination policy.

3. Implementation of examination policy.

4. Procedures used for review of WAEC Guide Syllabuses.

Instrument No. 2

The second instrument was a questionnaire administered to selected chemistry teachers at Alanamu Secondary School, and other schools within Ibadan municipality. The sample

surveyed also included administrators and some education officials in Oyo State. The instrument is divided into five sections. The first section was used to collect some demographic data about the respondent. The second section focused on probing each respondent to acquire some knowledge about his or her professional background. The remaining three sections are devoted to policy related issues, viz.:

1. The impact of WAEC examination policy on teaching.

2. The impact of chemistry textbook(s) on the choice of content.

3. The impact of the school level environment on chemistry teaching.

Instrument No. 3

This instrument was partly adapted from - "A Place Called School" (Goodlad, 1983). Goodlad holds the view that the amount of time spent on learning enhances students' achievement.

The instrument is divided into three parts. Section one contains the instruction for each respondent to follow. Section two contains four columns and ten rows. Respondents were expected to rank order their classroom activities in order of importance. Each respondent was expected to fill in his or her response in the space provided under each column. Section three was set to collect demographic data from respondents. Since the students have interacted with their classroom environment more than this investigator, their response and evaluation of the usage of available class time is a closer measure of reality than what any external observer can obtain in three weeks. Therefore, the students' response is considered a better gauge of how available time is used by the chemistry teachers. From a field research each respondent may be considered a participant observer.

Procedure

The researcher conducted structured interviews each of which was guided by open-ended questions contained in the interview protocols. Selected public figures in Nigeria and at the University of London were interviewed.

Five documents (which include: WAEC Guide Syllabus for O' level Chemistry 1985/86, the West African School Certificate examination papers 1 and 2 in Chemistry of June

1985, relevant sections of curricular material used for teaching O' level Chemistry, teacher-made tests at Alanamu Secondary School, and a teacher's notes for lessons on hydrogen) were analyzed for their contents referenced to the nine national objectives (see Table 2) for teaching chemistry in Nigerian secondary schools.

Insert Table 2 about here

The analysis was based on a conceptual framework adapted from Goodlad et al. (1979) (See Table 3).

Insert Table 3 about here

This investigator was interested in discovering first, whether there are discrepancies in the stated objectives and the patterns of implementation as exhibited by the documents, and second, whether some relationships exist among the patterns of implementing the examination/curriculum policy.

A survey questionnaire was administered to Chemistry teachers located in four different schools within the city of Ibadan, Nigeria. Seventeen teachers returned these questionnaires.

The researcher also conducted an ethnographic study at Alanamu Secondary School, Ibadan for a period of three weeks between March and May, 1987. As part of this study, the researcher examined the school level and the classroom level environments. A questionnaire was designed and administered to 153 students at Alanamu High School to provide additional evidence about the learning environment at that school.

Qualitative methods were chosen because the main objective was to provide a detailed descriptive account of the context and the research findings. Data analysis included preparation of quantitative data in the form of tables, charts and graphs. Frequencies, averages and percentages along with descriptive data from interviews, observations, conversations, and document review.

ANALYSIS AND INTERPRETATION OF RESULTS

The five public figures interviewed expressed concern about the need to change the orientation of students and the Nigerian public from regarding the West African School Certificate as a stepping stone to higher education to recognizing it, as an expression of the skills and knowledge which have been developed by students as a result of secondary science education.

The change in orientation will not occur quickly because attitudes toward examination appear to be deeply ingrained (Adeogun, 1985).

One important step to bring about this change is already in place. That is, the WAEC Guide Syllabus has a broad scope of objectives for chemistry education (see Table 4). However, examinations could coincide more closely to these objectives, increasing the emphasis on applications of science, logical reasoning, analytical thinking, and other skills that are pertinent to this changed orientation. Further, the data also point to a need for helping teachers broaden their orientation from heavy emphasis on concepts and principles of chemistry to applications and higher order reasoning skills.

Another meaning arising from the interviews is the need for research in WAEC. This was highlighted by the London and the Lagos respondents. The Lagos respondent would like to see more application of computer hardware and software in WAEC's operation in Nigeria. By so doing, parallel forms of the same test could be developed using a bank of test items. This would have at least two benefits: (1) The security of examination would be enhanced, because students could be randomly assigned to one of several examination forms available at a setting, (2) Students who fail and wish to retake the examination could do so at an earlier time than is presently possible. Also, computer usage could speed the scoring of examinations and reporting of results to students and other agencies.

Problems of WAEC's Operation in Nigeria

Several problems militate against the smooth operation of WAEC organization in Nigeria. Each problem is complicated with the rapid growth of the organization and the increasing number of students who sit for WAEC's examinations annually.

Since WAEC's examinations are recognized world-wide, the testing body has to maintain high standards in the development and administration of examinations on the one hand, and the reporting of test results on the other.

Still on standards the interviewees asserted that the crucial thing about testing is the nature of the test. The structure and contents of the examination is important. It must be clear to the test developer what the structure will be. That is whether all the questions will be multiple choice type, or essays. Another issue is test specification. Test developers must know what grid, what skills they are testing or hope to test. For example if they intend to test practical skills and/or observation skills, they should provide good specimens or slides in biology. For chemistry examinations, students should be provided chemicals that will give clear color change or easily observed thermal change be in exothermic or endothermic reactions.

Also related to maintenance of standards is the issue of security. Security is so crucial to test development, test administration and reporting the test scores.

Three respondents expressed some concern about examination leakages experienced by WAEC several years back. There have been leakages in schools, examination centers and even in the banks. One respondent said, "There is no 100% security in Nigeria because we cannot rely on the integrity of people. The Nigerian government encouraged security by making people serve long jail terms if they are caught in fraudulent practices.

The aim of the content analyses is to decipher the nature of the communication in the Nigerian educational system. How effective is WAEC in communicating its objectives for chemistry education to teachers? This is reflected in the content analysis data. Table 4 also indicates that the frequency is high for some of the objectives, and low for the others. Correspondence among the percentage frequencies

for each objective could be used to measure communication effectiveness (Hovland and Mandell, 1952). The four documents which represent policy implementation put together ranked the teaching of "principles and concepts" and "the teaching of chemical process" very highly. Taken individually, documents nos. 2, 3, 4 and 5 respectively devoted 43 percent, 52 percent, 38 percent and 66 percent of their contents to the teaching of the principles and concepts of chemistry. WASC examinations contained 43 percent and the local test underscored this point by having as much as 52 percent of the total test items on this objective. On the teaching of chemical processes, documents nos. 2, 3, 4, and 5 contained 20 percent, 20 percent, 15 percent and 17 percent respectively.

Insert Table 4 about here

The data in Table 4 show that the emphasis in WAEC Guide Syllabus varies considerably among the objectives. The frequency of appearance of objectives pertaining to concepts and principles of chemistry, chemical processes, logical thinking and application to life were high whereas objectives such as interest in chemistry, interrelations in science, and problem solving are mentioned infrequently. It is interesting to note that there is a high degree of correspondence between the frequency with which objectives are mentioned in the WAEC Guide Syllabus and the other four documents that were subjected to content analysis.

These data suggested that the WAEC Guide Syllabus is very effective in communicating to implementing agents including text writers and teachers. One area of discrepancy is logical thinking. In the WAEC Guide Syllabus logical thinking objectives rank third in frequency. In the other four documents this ranked sixth. In teacher's classnotes, they were virtually absent. It would appear that WAEC officials may need to place greater emphasis on objectives 1, 2, 8, and 9 (see Table 4) if these are to receive more attention in the curriculum and in testing.

On the other hand, looking more closely at data in Table 4, it is evident that teacher's notes and tests correspond less well to the guide syllabus than is shown in Table 4 when data are grouped. This suggests that individual teachers need some careful supervision. As will be seen in Section II of this chapter, many teachers feel at liberty to choose instructional contents with little regard for the syllabus.

The process of changing the WAEC Guide Syllabus usually is initiated internally. However, when the need is perceived by affected groups, it is possible to request a syllabus review. The process is both complex and slow because of its international character. To bring about a change in the syllabus affects people in five nations. Therefore,

provision must be made to allow all who are affected to be heard before WAEC will alter educational policy. Then, after a policy change is agreed upon by WAEC, the policy must be disseminated to the participating nations and eventually to all schools, teachers, administrators, and users of the certificate. This process takes five years.

While many people criticize this process as being unnecessarily cumbersome and slow, it does provide a measure of stability for educational policy. It helps to assure that policy changes do not occur in response to fads. With the broad scale of input, it should help to prevent excessive changes in educational policy. With broad scale input, in a democratic setting, it should also help the educational system, to serve the needs of society as a whole as well as the needs of individuals who comprise it (Eisner, 1983).

However, the measure of effective policy lies in its implementation by teachers and administrators in schools for the benefit of students. This is the subject of the next section.

The Behavior of Teachers

The students in this class worked in groups of twos and threes. For several obvious reasons instruction in chemistry lessons in this school and elsewhere in Ibadan was not personalized. The situation thus put a limit on student's participation.

Mr. Agbado tried to encourage independence when after the hands-on group work, he ordered the students to do the computation individually (See Table 5).

When the teacher was probed by the researcher concerning the use of textbooks, he said that he did not use the recommended textbook or any textbook for that matter. Observational data showed that he used a book with his classes. The volumetric titration experiment was adapted from a textbook by Oriaifo (1981) of practical chemistry for General Certificate of Education (GCE) 'O' level. Mr. Agbado tried to present himself as an expert, professional teacher with a wealth of experience. Thus, to admit dependence on a textbook in this case was probably perceived by the teacher as a sign of weakness, to be avoided.

Like the teachers at Brookview, England (Scarth, 1984), this teacher considered the preparation of his students for the WAEC's exams a serious matter and an essential service. This is probably why he scolded some students who appeared not to be serious with their assignment during the practical lesson.

The behavior of teachers could be summed up in terms of what activities they engage in inside their classrooms and laboratories -- the way they taught chemistry and the nature of their interaction with the students.

The researcher observed that the teachers used four instructional strategies in teaching chemistry. The strategies include: chalk and talk method, problem solving algorithms, group work, and examinations. These strategies were used interchangeably both in the classrooms and during the practical lessons in the laboratories.

The chalk and talk method, whole class, teacher directed instruction, was predominant at the three levels (classes 3, 4, and 5) of instruction observed at the school.

Students Perceptions of the Use of Available Class Time in Chemistry Lessons

The information provided here was collected from the students' response to Instrument No. 3. Ten important classroom activities adapted from Goodlad, 1984 were used to construct the instrument. The activities considered were:

A. Written Work
B. Being Disciplined
C. Reading
D. Use of Audio Visual Aid Equipment (AV)
E. Preparation for Assignment
F. Discussion
G. Test Taking
H. Watching Demonstrations
I. Listening to Explanation/Lecture
J. Free Time

This instrument was developed by the researcher after discussion with Dr. Barry Fraser of Western Australian Institute of Technology at the Michigan State University in 1985. He has done extensive research on classroom environments. He has also developed some instruments for measuring both the school level and the classroom level environments. He however, doubted their applicabililty in the Nigerian milieu. Fraser left the impression that students are better judges of their classroom climate than any external observer. This idea is also presented in Goodlad's famous book - "A Place Called School . . ."

In view of Fraser's comments, a new instrument was devised in which ten classroom activities were listed. One hundred fifty three students in classes three, four, and five at Alanamu Secondary School were administered the questionnaire. The students were required to rank the ten activities in order of their perceived importance and to estimate the amount of time spent on these activities in a typical class period.

The instrument were administered to 153 students by the class teachers in four classrooms. Table 6 provides some useful information about the time spent on activities and the rank of importance as perceived by the students in

classes 3, 4 and 5 at Alanamu Secondary School. Fifty copies of the completed questionnaire were randomly selected (Rees, 1985) by the researcher for this analysis.

The data presented show that the teachers have tried to do several things during their chemistry lessons. The classroom activities listed in Table 6 is a proof that teachers at one time or the other have used a number of them during a lesson.

Insert Table 6 about here

The record of students' achievements in the WAEC examinations is one of the best in Ibadan. It is most likely that this model of classroom climate is the reason for their success. The teachers gave top most priority to lecturing, which is communicating chemical information to the students. Second, they engaged the students in written work, perhaps some problem in chemistry which could be computational or descriptive. Third, they spent time to demonstrate experiments to their classes. This is an important strategy in situations where equipment and chemical substances are in short supply. The other two important, highly ranked activities are discussion and test taking. The remaining five activities were ranked at the lower wrung of the priority scale. However, one of these attacts some further consideration. This activity is <u>being disciplined</u>. Although it was ranked as 7.5 on the scale it took the highest amount of time (32.30 mins.) whenever it occurred. Almost half of the available time (70 mins.) for teaching chemistry may be spent on discipline. These data suggest that some students perceived that they are continuously disciplined during the class period. This resulted in (a) a high score for "being disciplined" (Category 8) and (b) a total duration of activities which exceeded the length of the class period.

One form of discipline was recorded in Table 5 where the teacher scolded some idle students. Teachers could find other forms of discipline that will not detract the attention of the whole class. The data show that part of the time meant for instruction is given over to classroom control.

RESEARCH FINDINGS

In Nigeria, formulation of examination policy is a national assignment carried out by policy actors which include: the Joint Consultative Committee on Education, the National Council on Education, agencies of the state and federal governments, for example, Nigeria Educational Research Council and Comparative Education Studies and Adaptation Center, representatives of the state ministries of education, universities, colleges, state chambers of commerce and the teachers' union.

Information about WAEC's policies or changes in policies normally is prepared in the printed form and disseminated nation-wide to implementing agents, for example, school administrators and science teachers.

A new syllabus takes 2-3 years to prepare and about five years before it can affect WAEC examinations, due to the complex structure of WAEC organization operating in five countries in West Africa, the desirability of broad based input prior to decisions about changes and the need for adequate dissemination and adjustment among teachers and other school officials.

WAEC's examination policy in Nigeria is influenced by two competing agencies of the government for example, Nigeria Educational Research Council and the Comparative Education Studies and Adaptation Center. These agencies work very closely with WAEC.

WAEC officials stated that there is need to increase research activities in the WAEC. Each activity should be designated to a specific research team. For example, one team can handle development issues, while another research team can deal with public relation matters.

According to those most closely associated with WAEC, the operation of WAEC has become rather complex thus increasing the need for computer hardware and softwares, which would facilitate WAEC's operation in Nigeria. This is in order because the entry figures and the total number of students who sat for WAEC's examinations have more than doubled in the last decade. Computer application should aid the operation of several divisions of the organization.

According to WAEC officials the chief examiners of WAEC should have a number of qualities which include the capacity to undertake quantitative analysis of WAEC's examinations, marking schemes and scripts, including pretest and post-test item analysis to establish difficult indexes, for the items and improvement of the quality of the methods of reporting WAEC's examination results.

According to many people interviewed, WAEC's academic standards are internationally recognized, but maintenance of standards is threatened by a lack of a fool-proof system of providing security for examinations in Nigeria. There has been leakages of examinations at school, in transit, in examination centers and in banks.

The goals of chemistry education as defined by the syllabus are broad and appear to have a dual orientation. First they appear to be directed toward development of scientific literacy (Miller, 1983). The greatest emphasis is placed on development of understanding of concepts and principles of chemistry, but other goals direct attention toward understanding of chemical processes, the applications of chemistry to life and logical thinking which also contributes to a broad understanding of chemistry as well as the development of higher order thinking. In addition, chemical processes

are included in the syllabus as a way of helping students relate chemistry to potential employment opportunities.

Content analysis data showed that the teachers paid more attention to WAEC examinations as they planned their assessments of students' learning then to the syllabus or the IUPAC textbook.

Content analysis of the five pertinent documents gave some important insights regarding communication between those who established policy and teachers who implement it.

First, nine objectives of chemistry education were portrayed in the WAEC Guide Syllabus. These representd a broad scope of intention for chemistry education. Not all objectives were given equal emphasis. For example, chemical processes and concepts and principles of chemistry were strongly emphasized whereas students' interest in chemistry received very little attention in the syllabus. The emphasis of objectives of chemistry education portrayed in the WAEC chemistry examination differed somewhat from those in the syllabus, but the general intention appeared to be carried out. However, there were some differences in degree of emphasis of some objectives.

First, comparing the WAEC Examinations and the local test, it should be noted that a key difference in the percentages lies in emphasis on development of logical thinking. The Examination has about 9 percent of the items focusing on logical thinking, whereas the local test only has 3 percent. Conversely, the local test has 52 percent of the items on concepts and principles of chemistry, whereas the WAEC Examination has 43 percent of these items. It would appear that the teachers tend to minimize teaching of logical thinking and give greater emphasis to concepts and principles. These results are consonant with what is known about teachers teaching in U.S. schools (NSTA, 1983b). Second, the teachers' notes represent a narrower interpretation of the objectives for chemistry education than is found in any of the four other sources. Again this is consonant with findings in other studies of teaching practices and teacher planning (Gallagher, 1984a).

The objectives of the IUPAC chemistry textbook which is widely used by chemistry teachers in Nigeria also differed somewhat from those in the WAEC Guide Syllabus but the variation with the WAEC chemistry examination was somewhat more pronounced.

Second, tests prepared by classroom teachers were clearly aligned with objectives portrayed in WAEC examinations but did not reflect syllabus or textbook objectives with as much accuracy. Again, the differences were in the degree to which each of the objectives were emphasized. Thus it appeared that examinations are a better device for communicating objectives of instruction to teachers than are either syllabi or textbooks.

Third, data from observation of chemistry classrooms and teachers' classroom notes which were used to guide

instruction represented a very narrow portrayal of the objectives of instruction. Since the teachers' practices in classes and their notes represented a selection of material from the adopted text and supplemental text, data from this analysis show that teachers' choices of content tended to focus on concepts and principles of chemistry such as the mole concept and to ignore the broader range of objectives of chemistry education, such as students' interest in chemistry and logical thinking.

The data suggest that examinations play a very important role in communicating the intentions and objectives of chemistry education in a manner that are difficult for teachers to ignore in the long run; in contrast, teachers can ignore significant parts of the information contained in syllabi and textbooks since there is no direct accountability pertaining to these guides as there is with examinations.

Most of the chemistry teachers in Ibadan area used the WAEC Guide Syllabus to plan their chemistry lessons. About 82 percent of the sample endorsed the WAEC syllabus as a good teaching guide.

About half of the chemistry teachers surveyed are underqualified. Given the lack of supervision and perceived freedom in selecting instructional content, educational officials can expect problems unless concerted action is taken.

Lack of adequate educational resources such as laboratory equipment and crowding in school laboratories has resulted in infrequent use of laboratory work as part of instruction in chemistry.

Observational data in classrooms and data from students' questionnaires show that teachers use a narrow repertoire of teaching strategies. Students have limited opportunity for practical work or for reflective discussion. Most instruction is didactic.

DISCUSSION AND CONCLUSIONS

The Nigerian government requires a standardized school certificate for those graduating from secondary schools nation-wide. To earn this certificate, students must pass WAEC examinations in required and elected subjects. Scores on WAEC examinations further determine admission to tertiary institutions and selection for available positions in public service departments. Thus, WAEC has significant impact at many levels throughout Nigeria.

The Impact of Examination Policy on Teaching

The evidence from the five sources viz., the interviews with educational leaders, the content analysis of documents, the questionnaire for teachers and students, and the field-notes written during the ethnographic study of Alanamu School

were combined to present a scenario of the impact of WAECs examination policies on teaching chemistry in Nigerian Secondary Schools. By so doing, the researcher was able to address the main research question of this study which is the following.

How does examination policy influence teaching of chemistry in Nigerian schools? The analysis of the data collected from different sources demonstrated the impact of WAEC's policy on chemistry teaching. At the formal level where textbooks and tests are developed, the response of the implementing agents appears to be satisfactory. The content analysis data justify this position.

However, a combination of the results of content analysis and classroom observation showed that policy and practice exist as two rather separate entities with policy having a somewhat limited influence on practice. For example, at Alanamu Secondary School, one of the teachers decided not to use the recommended textbook because it has so many pages. This teacher had a phobia for voluminous books. Another teacher did not use any book to prepare his lessons. His own claim was that he earned a bachelor's degree in chemistry, and with so many years of experience in teaching there should be no need to use a textbook to teach ordinary level chemistry. However, in his practical lesson, many of his students could not set up the apparatus in a way to obtain accurate values. The inability of schools and teachers to effectively implement WAEC's policy led many of them to engage in inventing shortcuts which would make their students pass the 'O' level chemistry examinations. The use of algorithms for solving chemical problems is a common example.

In the United States of America the federal and state governments have limited control of schools and schooling, control is at the local level. However, the parent-teacher organization (PTO) is a strong force. Parents are actively involved in their children's education. Because the populace of Nigeria does not have the educational level found in only industrialized nations, Nigeria has decided to utilize a centrally controlled educational system instead of a locally controlled one. Further, Nigeria has to invoke a method to ensure adequate implementation of both the curriculum and examinations policies by the school and the science teachers. This is an issue that the federal and the state ministries of education have to resolve with immediate dispatch in order to guarantee effective implementation of policy.

The processes which WAEC has in place for formulating and reviewing policy appear to be effective. They permit broad based input from many agencies and groups in the five participating nations as well as from the University of London. Also, within Nigeria and within the 21 states which comprise the nation, there are parallel organizational structures which foster this input from the many constituents who are affected by the policies which WAEC formulates.

It appears that parallel structures also exist in the other four nations comprising WAEC.

This system has resulted in stable educational policy. However, it is often criticized for being too slow to change. A five year time lapse between initiation and implementation of policy changes may be both necessary and desirable given the nature and importance of the educational system to a nation's future.

The WAEC Guide Syllabus in Chemistry serves as a guide for development of the WASC Examinations and is used by groups who prepare educational materials including textbooks. The Syllabi are widely disseminated throughout the nation and are used by some educational officials and teachers as guides for planning programs.

One concern which this researcher raises pertains to the emphasis placed on the various objectives that are presented. Concepts and principles of chemistry and chemical processes received the largest share of emphasis among nine objectives listed. Students' interest and interrelationships among the sciences are given far less emphasis in the syllabus. Results from studies in Nigerian schools showed that teaching practices corresponded to the differential emphasis in the syllabus on several items. If the objectives listed in the Guide Syllabus are important, why do some receive greater emphasis than others? Also, is the relative frequency of occurrence of mention of particular objectives in the Guide Syllabus a measure of the policy makers intended emphasis in the curriculum? If so, is there a better way to communicate this information to policy users?

However, it is in the area of implementation of policy that most concerns were raised in the mind of this researcher. Observations in classrooms in one of the best schools in the region were somewhat disappointing. Teachers seemed to be limited by lack of materials and supplies. This was supported by 41.2 percent of the teachers from other schools who indicated that equipment and supplies were not adequate for effective teaching. The paucity of educational resources at Alanamu School is included in the description of the setting in chapter three of Alao (1988). Moreover, in spite of the guidance provided by the Syllabus, 70.6 percent of the teachers surveyed said that they were free to choose instructional content. In addition, there seems to be a belief among well qualified teachers that adherence to the text and syllabus is a sign of weakness. As a result, some of the best qualified teachers appear to be diverting from expected content in this teaching. Also, there seem to be some difficulties with classroom control which interfere with effective teaching.

Many of these problems with implementation appear to arise from two probable sources, inadequate supervision and leadership. The traditional system of inspection appears not to be functioning as it should. This researcher has cautiously inferred that the principals are not exerting

sufficient leadership with their staff. Budget for supplies and materials either is not available or it is not being spent appropriately. As a result, the thoughtfully made plans of the WAEC system are not attaining the effects that are intended. This is a serious matter that needs attention from national and state ministries of education as well as other groups throughout Nigeria.

If the results found in this study are generalizable throughout the nation, educational leaders and public officials who are charged with protecting the national welfare should give careful thought to changes needed in implementation to educational policies. The findings of this study will come as no surprise to many in Nigeria who are associated with schools. Thus, these findings should give pause to educational leaders and public officials because so much is at stake that affects the future of our developing nation.

Data from the study suggest that examinations constitute a more effective device for communicating instructional intentions than either syllabi or textbooks. However, data also show that teachers acting without adequate resources and supervision frequently select instructional content and methodology that are inappropriate for the attainment of the intended objectives of secondary school chemistry. The conceptual content of chemistry receives most attention from teachers while laboratory work, higher order reasoning, and positive attitudes toward chemistry are virtually ignored by teachers even at Alanamu School, one of the best schools in the area. Behaviors represented in the syllabus are also under-represented in the classroom. The teacher dominates his or her classroom thus functioning as an active participant whereas, the students who are being trained continued to be passive observers in the classrooms. Students who are supposed to acquire manipulative skills are deprived the opportunity because of the strict and limited classroom environment.

This study adds evidence about the importance of the WAEC system in Nigerian education. WAEC is an important force for quality and stability. While a gap exists between policy and practice, the WAEC examination program, stimulates inclusion of broader objectives of chemistry education than would occur if teachers were permitted to make their own decisions on instructional content. Moreover, WAEC sets standards of quality and breadth of coverage of chemistry content.

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TABLES AND FIGURES

TABLE 1

NATIONAL RECORDS OF STUDENTS' ACHIEVEMENTS IN WAEC'S O' LEVEL EXAMINATIONS IN CHEMISTRY, MATHEMATICS AND ENGLISH LANGUAGE

Chemistry

Year	Entry	Total SAT	Credit	%	Pass	%
1980	73953	68179	8373	12.57	17809	26.12
1981	59698	50495	2043	4.00	5288	10.50
1982	120240	107826	18848	17.48	21533	19.97
1983	126946	113473	13966	12.30	23408	20.63
1984	125247	112729	28779	25.52	17106	15.17

Fail	%	Absent	%
23372	34.28	5774	7.81
43164	85.50	9203	15.42
67445	62.54	12414	10.32
76099	67.06	13473	10.61
66826	59.28	12518	9.99

Mathematics

Year	Entry	Total SAT	Credit	%	Pass	%
1980	163047	155597	18025	11.58	44425	28.55
1981	193929	166200	18768	11.30	52677	31.70
1982	304683	286920	38080	13.27	89495	31.19
1983	360591	341758	30399	8.89	95508	27.95
1984	405726	388346	40710	10.48	100374	25.85

Fail	%	Absent	%
86234	55.42	7450	4.57
94835	57.00	27729	14.30
159345	55.53	17763	5.83
215851	63.15	18833	5.22
247262	63.37	17380	4.28

English Language

Year	Entry	Total SAT	Credit	%	Pass	%
1980	174259	167482	22469	13.41	50263	30.00
1981	336622	302057	16525	5.50	56466	18.70
1982	309610	297921	24275	8.14	59301	19.90
1983	364725	355163	38935	10.96	82694	22.67
1984	407740	398767	57793	14.49	105354	25.84

Fail	%	Absent	%
90169	53.83	6777	3.89
229066	73.80	34565	10.27
214345	71.94	11689	3.78
233534	65.75	9652	2.62
235595	59.08	8973	2.20

TABLE 2

NINE CURRICULUM OBJECTIVES* FOR TEACHING CHEMISTRY
AT THE SECONDARY LEVEL OF PEDAGOGY IN NIGERIA

1. To stimulate interest in Chemistry.

2. To show students inter-relationships among the branches of science.

3. To teach students to understand chemical processes.

4. To teach students logical thinking.

5. To enable students to understand principles and concepts of chemistry.

6. To make students learn the applications of chemistry to life.

7. To assist students in developing manipulative skills.

8. To teach students report writing.

9. To help students develop problem solving skills.

*These objectives were identified by a panel of experts at the Michigan State University that reviewed one of the policy documents from Nigeria.

TABLE 3

LEVELS OF DOCUMENT REVIEW

Document	Ideal	Formal	Operational
1. WAEC Syllabus	X		
2. WAEC Exam		X	
3. School Exam			X
4. Chapter 13 of IUPAC Textbook		X	
5. Teacher's Notes			X

1. The ideal level at which the national philosophical direction of education is determined. This level is represented by the WAEC Guide Syllabus 1985/86.

2. The formal level which is the point at which textbooks and tests are developed. This level is represented in this content analysis by the chapter on hydrogen taken from the chemistry textbook widely used in Nigerian schools and the WASC O' level papers in chemistry of June 1985.

3. The operational level at which the teachers teach using the curricular materials with their students. This is represented in this analysis by two units namely, the teachers notes of lesson from a class at Alanamu School and the school's Form V Chemistry Paper two of the Mid-Year examination of March 1986.

TABLE 4

CONTENT ANALYSIS DATA FOR FIVE PERTINENT DOCUMENTS:
SPECIFICATION OF OBJECTIVES OF CHEMISTRY EDUCATION

Documents:	WAEC Syllabus		WAEC Exams		Local Test		IUPAC Textbook		Teacher's Notes	
Objectives for Chemistry Education	f_1	%	f_2	%	f_3	%	f_4	%	f_5	%
1. Stimulate interest in chemistry	2	0.87	0	0	0	0	1	3.85	0	0
2. Teach inter-relationships in science	3	1.31	0	0	0	0	3	11.54	0	0
3. Teach students chemical processes	59	25.76	15	19.74	41	19.81	4	15.38	2	16.67
4. Teach logical thinking	38	16.59	7	9.21	3	2.83	0	0	0	0
5. Teach principles and concepts of chemistry	64	27.94	33	43.42	55	51.89	10	38.46	8	66.67
6. Application of chemistry to life	36	15.72	2	2.63	4	3.77	4	15.54	0	0
7. Develop manipulative skills	21	9.17	6	7.90	2	1.89	3	11.54	0	0
8. Teach report writing	1	0.44	0	0	0	0	0	0	0	0
9. Develop problem solving skills	5	2.20	13	17.10	21	19.81	1	3.85	0	0
TOTAL	229	100.0	76	100.0	106	100.0	26	100.0	12	100.0

f = frequency

TABLE 5

FIELD NOTES

SUBJECT: Chemistry OBSERVER: DAA

CLASS: SSS-2

TEACHER: MR. Agbado (Psuedonym)

Time	Teacher	Students
	Teacher wrote the instruction for the practical on the chalkboard. Students were divided in to groups of 2-3 to work on the project.	The students started their project. Some were writing, some were setting up the apparatus.
8:52	"One person at a time should do the titration."	
8:54	The teacher reprimands a student in Yoruba.	Another student compliments teacher in Yoruba.
8:57	He walks around and reprimands one or two students.	At this point some of the students have gone far with the first titration some were still getting started.
8:59	Advised students to stop when they see the color change.	Some students have seen the color change. Some students have their burrette tilted some have their burrette at a higher elevation.
9:04		Some have problems. Students are expected to carry out 4 titrations. Some have done 3 already. Some 2, some 1. Some students are going for just 2 titres only. Students have the freedom to choose the number of titrations to conduct.

TABLE 5 (Cont.)

9:06	He went out of the lab.	
9:12	"Before you start your calculations at all make sure your apparatus is returned."	A group of students (2) have passed the end point and did not know until the observer intervened and stopped them.
9:18	Teacher helps students return the glassware.	Students begin the calculations and group members return apparatus after they have cleaned them.
9:22		3 groups are still titrating.
9:26	"No consultation with anybody. Do your calculations on your own. Not even with textbooks."	
9:30	"There should be no copying of other people's work. Stop where you are stuck, I will explain later."	

Below are the outcomes of the volumetric titration conducted by group no. 1.

TITRE VALUES

Burette Readings	1	2	3	4
Final	20.1	33.3	41.2	45.0
Initial	0.0	13.0	21.0	25.0
Net Volume	20.1	20.3	20.2	20.0

Average $20.15 cm^3$

AVE = mol_b = 0.06209

TABLE 5 (Cont.)

Below are the outcomes of the volumetric titrations conducted by group no. 2.

Burette Readings	1	2	3
Final	21.30	42.60	21.50
Initial	0.0	21.30	0.00
Net Volume	21.30	20.70	21.50

Probing the Teacher by the Observer

Teacher

Observer: What textbook do you use?

Teacher: I do not use a textbook.

Observer: Are you a graduate of University Ibadan.

Teacher: Yes, I graduated in 1973.

Teacher grades some papers.

Comments on students work
1. Not consistent
2. Too high

TABLE 5 (Cont.)

Below are the outcomes of the volumetric titration conducted by group no. 3.

Burette Readings	1	2	3
Final	19.6	19.5	19.4
Initial	0.0	0.0	0.0
Net Volume	19.6	19.5	19.4
Too low	$19.6cm^3$	$19.5cm^3$	$19.4cm^3$

TABLE 6

THE ORDER OF IMPORTANCE OF CLASSROOM ACTIVITIES IN CHEMISTRY LESSONS AT ALANAMU SECONDARY SCHOOL, IBADAN

Column #1	Column #2 Classroom Activities	Column #3 Mean of Time Used (Mins)	Column #4 Order of Importance (Mean)	Column #5 Rank of Importance
A	Written Work	23.96	3.74	2
B	Being Disciplined	32.30	6.62	7.5
C	Reading	17.30	5.96	6
D	A.V.	20.78	6.62	7.5
E	Preparation for Assignment	12.84	6.92	9
F	Discussion	18.34	4.26	4
G	Test Taking	24.74	5.62	5
H	Watching Demonstration	21.36	4.06	3
I	Listening to Lecture	23.52	2.96	1
J	Free Time	9.06	8.22	10

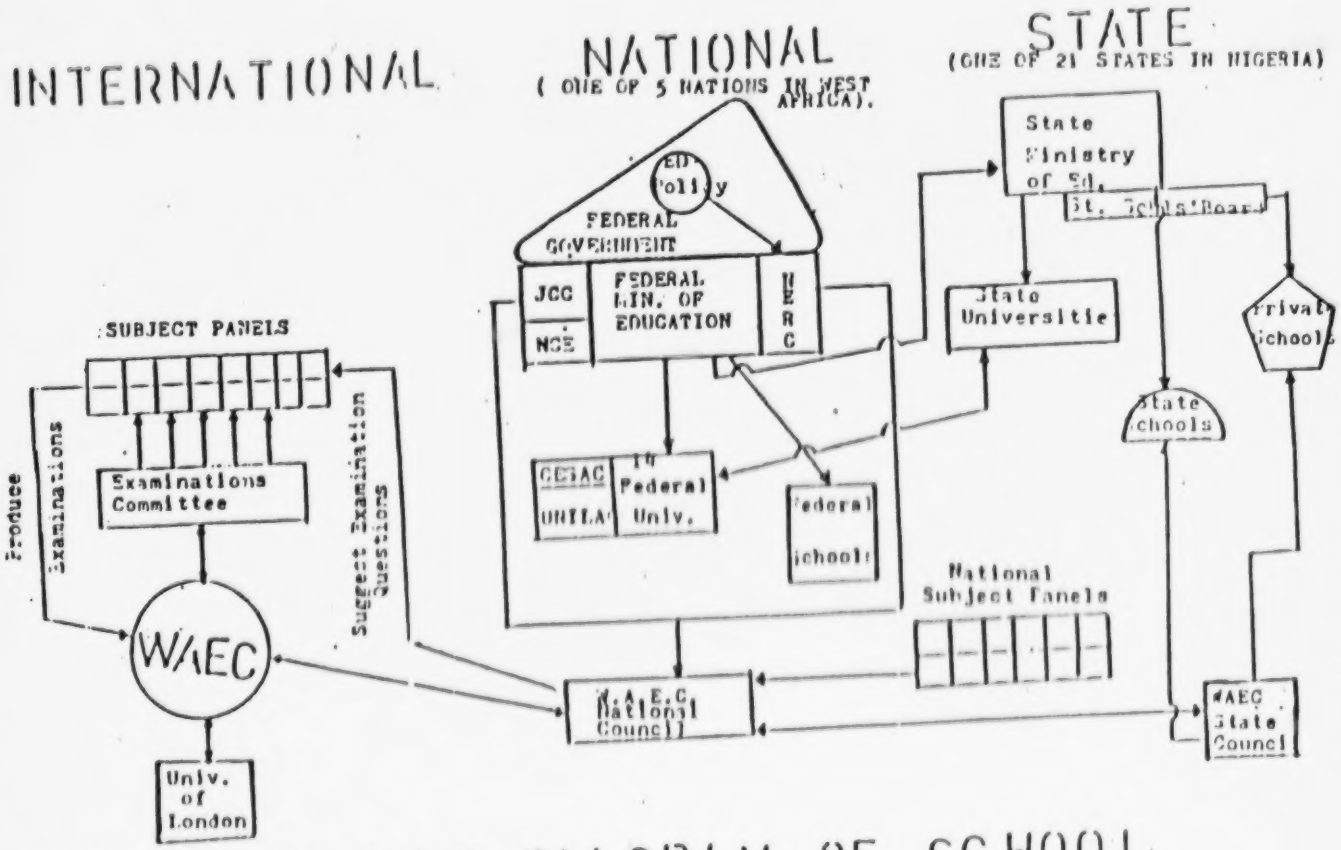

FIG. 1: SCHEMATIC DIAGRAM OF SCHOOL ORGANIZATION IN NIGERIA

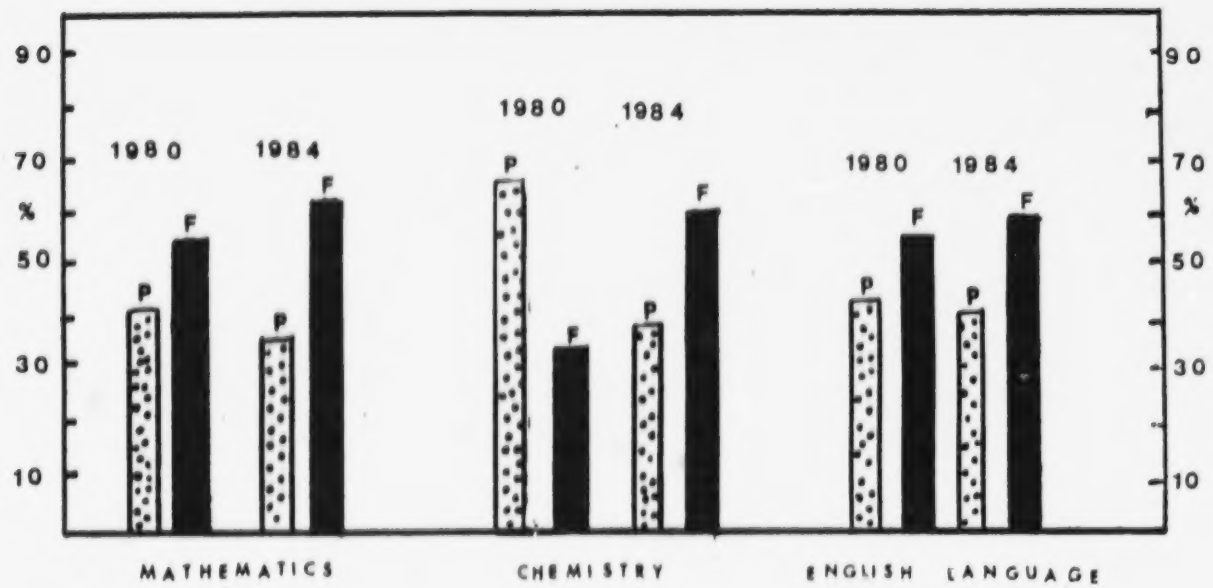

Figure 2 - Comparison of the Proportion of Candidates Who Passed and Failed Three Subjects Between 1980 and 1984